

Technology magazine

- a news
magazine for
engineers in the
Volvo Group

No. 2 2002

VOLVO



**Paperless
office for Buses**

**Eye behaviour
research
enhances safety**

**Research
benefits Europe
and Trollhättan**

**Impressive
3P Tech Show**

**The Volvo
Anti-theft System**

**Industrial
PhD programme
at Volvo 3P**

Embracing a multi-brand philosophy

The advances achieved by the engineering functions of the three Volvo Group truck companies (Mack, Renault and Volvo) worldwide, under the pressures of the integration process, are worthy of high recognition. Despite a number of major challenges, all have continued with their work and achieved significant progress under difficult conditions.

In particular, the recent 3P Advanced Engineering Tech Show



in Lyon demonstrated that a great deal is happening on every front within the product development functions of these companies.

Our work during the integration process shows that there are still many issues to be addressed – and very many attitudes to change – at both local and global level. Much criticism and many questions have been raised in what is a complex organisation, and we could not have moved forward without these

discussions. However, the way ahead is now clear, and the time has come for all of us to genuinely implement our new, multi-brand, globally focused organisation.

While many of us are working hard to build the new organisation, I know that not everybody understood the full potential of what was achievable when the new organisation was first announced. However, we must all take a hard look at the reality of the truck industry today. The higher demands to which truck-makers are now exposed make joint R&D a necessity and show that operation of the truck businesses on a standalone basis is not a viable scenario in the long term. The combined strength of Mack, Renault and Volvo provides us with a great opportunity. We are on the way to developing the first world-wide platform in the truck industry. We have the capability to become No.1 in the world in the years ahead – a position which none of the companies could realistically have achieved on its own. I am happy that the merger has taken place since it gives us the opportunity of becoming a true world leader in our industry.

Ultimately, we will overcome the problems – we have the knowledge and the skilled people to do it! Strong leadership will also be essential.

Our volume base is such that we can work closely with key global suppliers as preferred customers. This enables us to be the first to benefit from their innovations and to secure optimal long-term partnerships with them. Product development is an integral element of all purchases and the process is working extremely well.

This combination of factors gives

us sufficient strength to defeat our competitors!

The full implementation of segmentation and a multi-brand philosophy is of vital importance. Our organisation is now geared to meet this challenge and all of us must work towards the same goal!

I feel that the integration process has gone well in North America, with Greensboro focusing on high-way trucks and Allentown on the vocational sector. We need to carry through this thinking in Europe, where Lyon, for example, should be focusing on distribution – everywhere and not just locally.

Although we have to work in multi-brand mode, it is equally important to protect and support the individual image of each brand. Thus, Volvo is world-famous in the long-haul sector, while Renault is known for being ‘innovative’ and ‘caring and daring’, and Mack’s durability will forever be synonymous with the slogan ‘Built like a Mack’. We will remain faithful to these concepts!

I firmly believe that our present course is the one which will best support and preserve our three strong brands – both now and in the future. We have to combine our forces and we have the chance to do so now. Serving more customers will be our means of survival.

This is an exciting time. There are very many success stories and we have made significant progress towards full integration!

Hugo van Belleghem

Senior Vice President,
Product Development, 3P

Cover photo: Work in full swing at Volvo Buses' new experimental workshop.
(Photo: Roger Lundsten)

Paperless office for Buses

Photo: Roger Lundsten



Not a scrap of unnecessary paper, a meticulously designed office layout and a generously sized workshop – Volvo Buses' new product development facility is purpose-built for its application!

IN AUGUST, the Volvo Buses development department moved to new premises in the rapidly expanding Göteborg harbour area of Arendal.

Lars-Eric Ericsson, head of the Volvo Buses technical departments at Product Development, was in charge of the move. The project manager was Ingmar Börjesson, head of the prototype workshop and testing function.

The entire Product Development workforce – 250 office staff and a total of almost 60 workshop personnel – has been transferred to ARAK (office) and ARAL (workshop), as the two parts of the facility are known.

Right on time

"The timetable, which was finalised in December 2001, was adhered to exactly," comments Lars-Eric, "as was the cost schedule. This included a considerable amount of personnel training, particularly in the use of Outlook. Our aim is create the truly paperless office. Outlook contains a series of functions which can be used to replace paper transactions, especially document storage. For this reason, nobody is allowed more than one bookshelf – and there are no exceptions!"

There are basically no partitions in the office, except around the centrally located conference and printer rooms, and the

small, individual workrooms which are required. The workplaces are positioned four-by-four in a configuration which eliminates the feeling that there is somebody 'looking over one's shoulder'.

"We have also been able to equip the conference rooms with PCs since the engineers no longer need both a workstation and a PC. The modern workstation has a 'virtual PC' built in," explains Lars-Eric Ericsson.

"Everything that was done as part of the move was costed and everything that we do has to be profitable. To this end, we have established an in-house committee, with floor managers, to ensure that standards are maintained and all viewpoints are considered."

There are basically no partitions in the office

Lars-Eric Ericsson (right) and Ingmar Börjesson.

Security rules

Lars-Eric explains that the move to the three-storey building was made on the basis of security. The ground floor is occupied by a public restaurant and assembly area, a reception desk and departments with a largely customer interface – purchasing, service publications and product lines. The first floor is occupied by the groups working on frames, installation and vehicle dynamics, as well as projects. The second floor, which is the most secret, houses the advanced engineering, powertrain and electrical/electronic system groups.



Photo: Roger Lundsten

Behind chassis: From left: Olav-Tore Heimholt, Lars-Eric Thorin, Dan Lindberg and Göran Magnusson. In front of chassis: Göran Hermansson-Malm (kneeling) and Mikael Brude.

The generously sized workshop is located in the adjoining building.

"This is the reason we chose this precise location," says Lars-Eric. "Autoliv built the workshop to produce an order which fell through, and we were able

Continued on page 7



Photo: Roger Lundsten

Eye behaviour research enhances safety



Trent Victor uses a simulator to study his own eye movements. Every movement is recorded by the two cameras and displayed directly on the adjoining monitors.

Trent Victor has been working at Volvo Technology (VTEC) for a number of years as a PhD candidate from the Graduate School for Human Machine Interaction at Linköping University. His field is the behaviour of the human eye when driving a vehicle. He tells us that knowledge of eye responses can be used to design out distracting product characteristics and to develop new ways of maintaining driver attentiveness while driving.

ENTITLED *Driving Support from VISual Behavior REcognition (VISREC)*, Trent Victor's project is co-funded by the the Program Board for Swedish Automotive Research.

"The basic objective is to prevent accidents due to lack of attention. This may be caused, for example, by a mobile phone, drowsiness or other distractions," he explains. "We want to identify new applications and products which enhance safety."

"There are several people working on Attention Support Systems at VTEC. My focus has been to examine specifically how eye behaviour can be used in this context, as distinct from other sensors, such as radar, lane tracking or steering wheel movements."

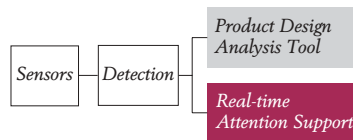
Accident statistics show that driver inattention (visual distractions, 'looking-without-seeing' and drowsiness) is the primary cause of accidents. In the USA alone, this represents 1.2 million collisions per year, mainly of the rear-end and run-off-road types (Wang et al., 1996).

Three-stage approach

Trent explains that the work is carried out in three stages under the headings of *sensors, detection*

Accident statistics show that driver inattention is the primary cause of accidents

A truck driver can be distracted by a great many things while on the road



and applications.

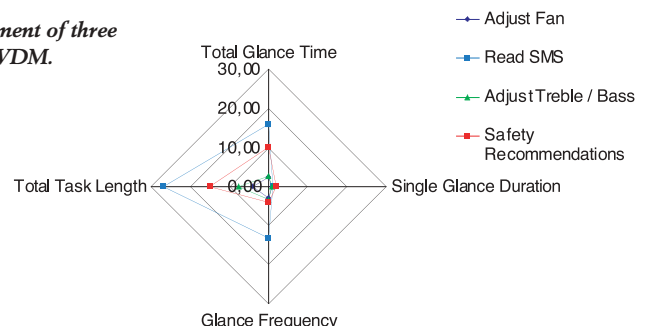
"A truck driver can be distracted by a great many things while on the road. We must do everything possible to design out the causes of distraction. By participating in the development process, we can use simulations and interactive testing to determine, for example, if a new driver display on the instrument panel presents such a risk," says Trent.

"We have developed the VDM (*Visual Demand Measurement*) tool, which enables us to evaluate systems such as those in a new truck. Until now, it was possible to analyse eye movements only by manual methods using a video. Now, for example, we can evaluate an on-board information system in a few minutes rather than several days."

FaceLAB tool has Volvo roots

He explains that Volvo has been involved in the development of an eye movement detection

Measurement of three tasks by VDM.



system known as *FaceLAB* in collaboration with the Seeing Machines company. In this system, the driver is studied by two cameras and all information describing where his (or her) gaze is directed, and how often and for how long the gaze is averted from the road, is recorded and analysed by VDM.

Taking his place in the laboratory's driving simulator, Trent studies his own eye movements in real time on the monitors beside him. The direction of movement is indicated and amplified by small traces.

"A researcher from the Australian National University (ANU) arrived here in 1996 with the idea of undertaking a collaborative research project to develop the sensor. Volvo and ANU subsequently decided to invest their rights to the technology in a spin-off company called Seeing Machines.

"So the company is part-owned by Volvo, and FaceLAB is now used by most automakers, as well as by research institutes and universities.

"The sensor has practically become an industry standard, and works well for analysing eye and head movements, as well as eyelid closure," explains Trent Victor.

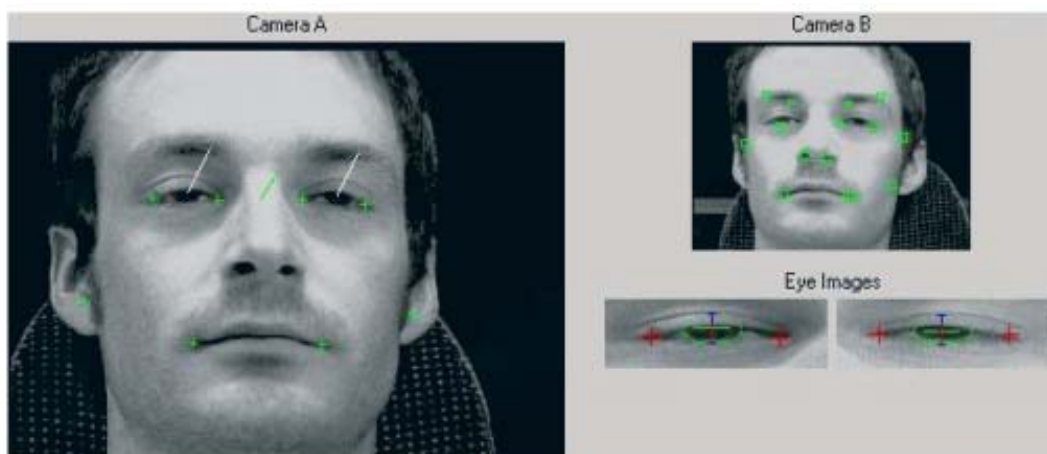
Causes of distraction

Acting as sensors, the cameras record an enormous volume of data describing the subject's eye and head movements. This yields information on what the driver is doing, what distracts him and what makes him tired, or even stressed.

"So how do we recognise distraction from the data we record?" Trent answers his own question:

"We traditionally use four parameters to analyse eye movements in order to design out distraction:

- Total task time
- Total glance time (total number of glances away from the road)



C Glance frequency (number of glances)

D Single glance duration (average glance length)

"Research has shown that eyelid closure (calculated using the PERCLOS algorithm) is an important parameter in determining that the driver is tired. Head movements are also of interest since they can indicate both tiredness and a high workload.

"These parameters are assigned to the three functional areas of *drowsiness*, *distraction* and *workload management* as part of real-time Attention Support."

Own measure of distraction

"I have also developed a new measure of distraction which I call *Percent road centre*. This describes how often the driver looks at the road during a specified period of time," adds Trent Victor.

"Percent road centre correlates very well with other glance-based indices. An advantage is that comparisons can be made with normal driving and all of the results can be computed in real time."

The recorded measurements of various movements and deviations – not only from eye behaviour analysis, but also from sensors such as steering wheel movements and lane trackers –

can be used to design various countermeasures to distraction, high workload and drowsiness. Typical examples of possible functions include:

Drowsiness management

- to provide warnings and information in the event of drowsiness.

Distraction management

- to remind the driver to return his gaze to the road in the event of a serious distraction;
- to provide an earlier collision warning if the driver is looking away from the road or starts to doze off;
- to programme the automatic cruise control system to widen the distance with the vehicle ahead if the driver is distracted.

Workload management

- to delay incoming messages (such as phone calls) until the driving situation has eased;

The images clearly show that the driver is drowsy – an appropriate time for a warning to stop and rest.

In physical terms, it is becoming easier and easier to drive a big truck

The message readout can be paused and the sound muted automatically when the driver's workload is high.

- to pause verbal or auditory information (such as e-mail or message readouts);
- to simplify text and symbols on a complex display.

General

- to provide post-trip information reporting the driver's attention history (how tired or distracted he was, how high his workload was, whether he 'wandered' on the road, and so on).

"These 'antidotes' or countermeasures, otherwise known as Attention Support HMI, are now under study as the final phase of my thesis."

More and more distractions

"In physical terms, it is becoming easier and easier to drive a big truck. The downside is that there are more and more things to distract the driver, such as phones, displays, TV, the Internet, and so on," declares Trent Victor.

"We must help drivers to realise the consequences of inattention – something of which he may often be unaware for precisely that reason! The solutions should be perceived as discreet suggestions, not as irritating reminders." ■





Research Director and Professor Bengt-Olof Elfström uses his big whiteboard to describe VAC's research programmes.

Research benefits Europe and Trollhättan

Basic technological research at Volvo Aero is carried out partly under the aegis of the Swedish National Aeronautical Research Programme (NFFP). The findings contribute to raising levels of competence in Swedish universities and institutes of technology, generating greater competitiveness for positioning within the EU, and strengthening the corporate climate in the city of Trollhättan and its environs.

ESTABLISHED IN 1994, NFFP is about to enter its fourth phase. Volvo Aero (VAC) has committed SEK10 million and Saab SEK20 million to the current three-year NFFP3 programme, a total matched by the Swedish government through the Swedish Defence Materiel Administration (FMV) and the Swedish Agency for Innovation (VINNOVA).

The two companies have sponsored 50 PhD candidates as part of their comprehensive programme of collaboration with almost all of the Swedish universities, notably the active Trollhättan-Uddevalla University of Technology. About 30 professors are engaged as tutors.

One of these is Bengt-Olof Elfström, research director at Volvo Aero and professor of product development at Luleå University of Technology.

Extensive VAC involvement

Bengt-Olof outlines the various relationships which exist between basic research projects carried out under the NFFP umbrella, to illustrate the importance of VAC's research to the EU's framework programme and to regional growth in Trollhättan:

"A concept originated by a

university can be developed further in up to five stages through demonstrator projects at VAC to become part of a project within the EU's framework programme. Product development at VAC brings the project to 'Stage 9', which means that the product is air-worthy and can be manufactured commercially," explains Bengt-Olof.

In this context, he draws attention to the EU's fifth framework programme, in which VAC is deeply involved both in projects, and in the *Clean* and *Antle* demonstrators (whose goals are to reduce emission levels and operating costs). With its unique experience in the simulation field, Luleå University of Technology is also a participant in these projects.

The knowhow gained from these activities will be carried forward into the sixth framework programme, which is scheduled to commence in 2003/2004. In the military sector, similar activities have been initiated as part of the European Technology Acquisition Program (ETAP).

"The foundation provided by NFFP is a major advantage to our participation in EU projects"

Projects under way at Volvo Aero include 'Virtual manufacturing in product development' carried out by NFFP doctoral candidate Daniel Berglund (nearest camera) and 'Manufacturing and modelling of fabricated structural components' carried out by EU doctoral candidate Henrik Alberg, both of Luleå University of Technology.

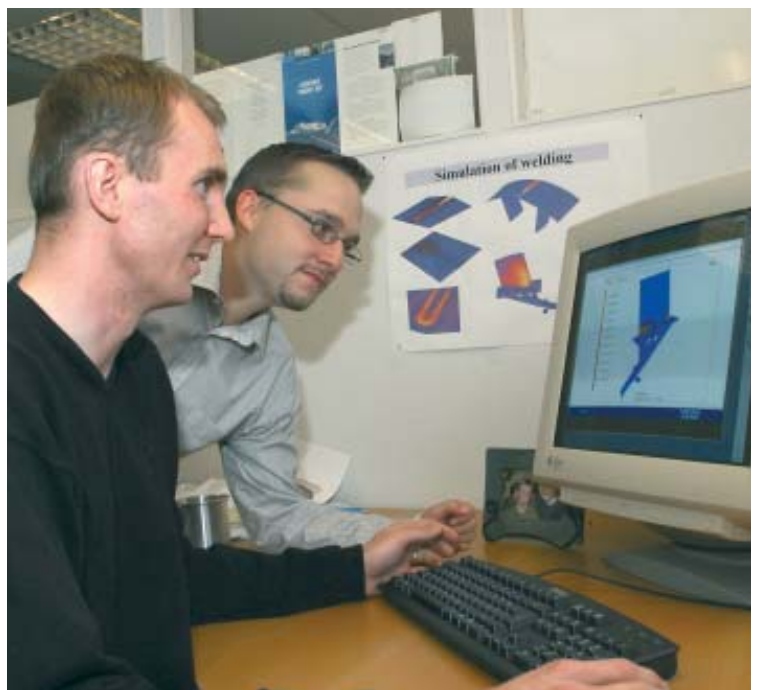


Photo: Göte Eriksson

Major players

A number of major projects in which VAC will be a leading participant alongside Airbus and Rolls-Royce have been launched in the civilian sector. The objective of the 'First Call' will be to secure resources for a project – *Vertigo/Viaduct* – to study virtual solutions, as well as business concepts and their effects on the product concept. This programme will cost an estimated SEK500 million. Costing SEK400 million, another project (*Inrem*) involving Rolls-Royce and VAC will simulate the production plant of the future.

The 'Second Call' a year later will deal with planning for a project known as *VITAL*, whose aim is to demonstrate a competitive aircraft engine complying with future environmental standards. The project will cost an estimated SEK1 billion.

"The foundation provided by NFFP is a major advantage to our participation in EU projects," stresses Bengt-Olof Elfström. "Ericsson Microwave is about to become involved in the activity and we hope to increase the government's – and our own – commitment to SEK50 million in a new stage of NFFP."

Innovatum hatches ideas

"Apart from providing a platform which enables us to become involved and establish a presence in Europe, NFFP has given us an opportunity – thanks to our major involvement in

modelling, simulation and visualisation – to add the University of Technology here in Trollhättan to the exclusive company of the most reputable universities in Europe,” adds Bengt-Olof.

Since 1999, local activities have been coordinated by a technology centre known as *Innovatum*, which administers the smooth-running cooperation between the Volvo Aero, Saab and Film i Väst companies, mainly in the areas of design, production and media.

“The university’s three main departments, *Manufacturing Engineering, Media and Work Integrated Learning* (we hope to involve the fourth, Health and Handicaps, at a later date), are ideal for the purposes of our collaboration,” declares Bengt-Olof.

“The objectives of Innovatum and the joint ventures – for example, sourcing production tools locally – should create 200 more jobs in the region. This should enable us to deliver the world’s shortest lead time from order to finished product.”



Photo: Göte Eriksson

Everything simulated

Bengt-Olof explains that DLP (Digitally Linked Process Control) is an important Innovatum project.

“We are aiming to develop a fully simulated production environment,” he explains. “Nobody

The DLP project at Innovatum in Trollhättan is directed by Project Manager Patrik Andersson (right), assisted by production technician Mikael Andersson.

can offer that at present. All of the company’s systems, including its learning processes, should be digital.”

He mentions Volvo Aero’s Linux cluster of 150 ordinary desktop PCs, which was assembled by a summer trainee a few years ago:

“At the time, this was the second most powerful supercomputer in Sweden – and it cost a mere SEK1.5 million!”

A brief description of Volvo Aero’s research activities within NFFP and the EU’s framework programme might make them sound relatively abstract. But the fact is that VAC and other companies in the Trollhättan area are clearly world players in the context of the aircraft industry of the future, and in terms of the most up-to-date production technology used in manufacturing industry today! ■

Photo: Roger Lundsten



Göran Hermansson-Malm pictured beside the cutting machine.

agreement with a consultancy firm to carry out rig testing. The space originally earmarked for the laboratory was given over to a project room, in which we can develop complete buses and view the results as they emerge by displaying digital models on the wall. Adjoining the project room is a software lab where we can simulate complete buses.”

He is also proud of the fact that Volvo Buses is pioneering the very latest ‘caD’ system, Catia V5.

“Since design is the priority, only the ‘D’ is a capital,” explains Lars-Eric. ■

Continued from page 3

to lease both it and the newly built office through the Volvo property company, Danafjord – at the same cost as our former premises. The workshop is equipped exactly to our requirements, partly through the pur-

chase of used machines. Since we sold our old machines, it was not especially expensive to equip the new premises.

“The materials testing laboratory was the one facility which was not moved. This problem was solved by concluding a joint

“The workshop is equipped exactly to our requirements”



The impressive range of development projects on which Volvo Group researchers are working at present was demonstrated clearly at the 3P Product Development Tech Show held in Lyon at the end of November. With Bernard Favre of 3P AE, Lyon as host, 3P's Advanced Engineering function, led by Niklas Hamnstedt, exhibited 40 exciting projects to the 80-plus participants.

IN HIS INTRODUCTION, Hugo Van Belleghem declared that technology, combined with efficiency and competence, is 3P's highest priority. Using a seafaring analogy, he reported that the crew of the 'Good ship 3P' were ready and able to meet the tough challenges which still lie ahead.

"It was not easy to select the projects to be exhibited at the show," Niklas Hamnstedt explained. "We had about 100 to choose from, but we were forced to limit the number to 40. However, I believe that these clearly illustrate the scope of truck-related research and AE work being carried out by 3P, Volvo Technology and Volvo Powertrain."

The projects in question (some of which are still current) were conducted at Volvo 3P's

Three powerful Renault trucks were the first sight to greet visitors to the 3P AE Tech Show.

The projects were conducted at Volvo 3P's four development centres

One of the trucks was packed with interesting safety features.



TechShow

four development centres in Allentown, Greensboro, Lyon and Göteborg. Some were undertaken jointly by more than one centre, while others were exclusively local.

There were six project classifications, each represented by 6-8 projects. The areas were:

- Calculation, simulation and methods
- Safety
- Productivity
- Environment and materials
- Vehicle and transport systems
- Comfort, ergonomics and human factors

'Massage seat'

Our first visit was to the sixth area (*Comfort, ergonomics and human factors*), where we found a number of driver's seats connected to a computer. This project has a number of different aspects and Maniphet Luong Van describes her experiments with a 'massage seat' designed to prevent back pain.

"We study the movements of the spine while driving," she explains. "The spine needs to move and the purpose of the project is to test a massage system which permits that."

"It is important that the vibrations are in tune with the frequency of the cab movements. Studies show that the driver is often seated incorrectly and has difficulty in altering his or her position. The massaging action is useful for this reason," she believes.

Universal rear and silent head

Maniphet Luong Van tells us that she is studying seating comfort in trucks for her doctorate, although a great deal of research remains to be done.

"Comfort also costs and the problem is to identify solutions which combine satisfactory characteristics with the right cost structure in production-ready products."

She also describes the Renault Trucks test module, which resembles the human rear and permits the comfort of the seat cushion to be evaluated objectively. The module is universal and can be adapted to simulate humans of all sizes and weights.

"This provides an objective way of talking to suppliers and customers," she says and goes on to describe some of her work on the 'silent head', a method of filtering off low-frequency noise from an area around the driver's head. This is a project which attracts a great deal of curiosity.

Coloured plastic

The *Environment and materials* area includes a number of interesting projects from the USA – one dealing with a carbon fibre bonnet several kilograms lighter than conventional components, and another with aluminium brake drums. Other exhibits include the exterior noise control and exhaust active muffler projects from the chassis department at 3P in Lyon, both conducted by Philippe Vignassa.

A project on the use of an environmentally compatible plastic in cab exteriors was the 'baby' of Karl-Johan Bengtsson of Cabs, Exterior in Göteborg.

"Sixty-five percent of all of our cabs leave the plant as 'white goods' and painting accounts for 60% of the cost of finishing a cab-in-white. To reduce this cost, we have developed a coloured plastic possessing the necessary environmental and durability properties. This offers the prospect of considerable savings, which is not usually the case with environmental solutions," he says.

Karl-Johan notes that the plastic is a 100% renewable, biological polymer made from cellulose

Bernard Favre and Niklas Hamnstedt organised the Tech Show.



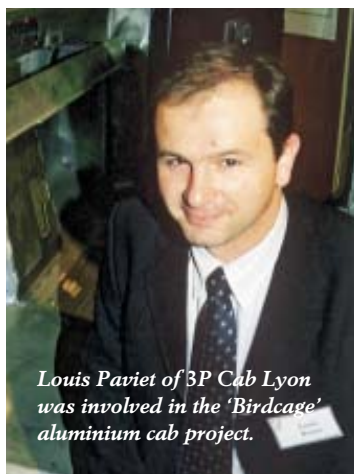
The driving simulator for filming eye movements aroused great interest among the 80-plus participants.



Maniphet Luong Van is developing a 'massage seat' for trucks.



Louis Paviet of 3P Cab Lyon was involved in the 'Birdcage' aluminium cab project.



Day Two of the Tech Show was devoted to a series of interesting workshops. Strict secrecy was the order of the day.



extract, in other words, from plant fibres such as maize flour or wood. The material is also flexible and suitable for injection moulding.

Safe tunnels

Safety is always of interest in a Volvo context and the exhibits included the EU *Safe tunnel* project, in which 3P is a participant. The system enables a truck to communicate with its environment and warns the driver against entering a tunnel with a fault capable of causing an accident. The vehicle's own sensors interact with those of the surroundings by means of an advanced telematics system. This is certainly an area of current interest given the number of tunnel accidents which have occurred in recent years.

Demonstrated by Anders Agnvall and Petter Larsson from Volvo Technology, the equipment used to analyse eye movements (described in another article in this issue) was also on view at the Tech Show.

Valérie Delachat from Lyon described her *Steer-by-wire* and *Drive-by-wire* projects – another area of extensive research in the



Karl-Johan Bengtsson demonstrates the biological polymer plastic which has been developed to protect the environment and save money.

industry. One of the exciting projects in the area of Vehicle and transport systems was entitled *Virtual tow bar – automated platoon*, a system which 'pulls' the truck along as though on a string when driving on the motorway.

Mack 'Birdcage'

The middle of the floor was occupied by a Mack cab. Louis Paviet tells us about this joint project between Mack and Renault:

"We call it the 'Birdcage'. The

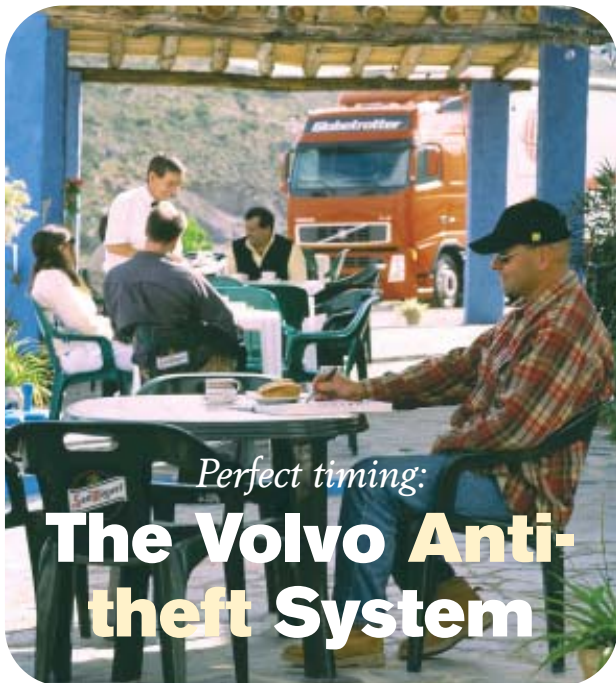
purpose was to manufacture a complete cab (such as a series CH unit) from aluminium," he explains. "We wanted to see if an aluminium cab has the same torsional rigidity, the same crash resistance and the same durability as a steel one."

"The cab is built from extruded sections joined by aluminium welding. The basic frame is built from sheet moulding compound (SMC) panels for rigidity. The biggest advantage is the 40-45% reduction in weight.

"Four prototype cabs have been built and we have even crash-tested one of them. The results comply with all of Mack's standards," says Louis Paviet, not without pride.

Although the 3P AE Tech Show could fill many more column inches, the above projects should provide a flavour of the hectic pace of activity in product development today. To the observer, this offers enormous hope for the future! ■

"We wanted to see if an aluminium cab has the same torsional rigidity as a steel one"



The day before **Technology** interviewed Lars Göran Ek about the Volvo Anti-theft System, the **Göteborgs-Posten** daily reported on the rapidly increasing wave of truck robberies currently taking place on the roads of Sweden and other countries. In this situation, the introduction of an anti-theft protection system for truckers is certainly well timed.

"HIGHWAY ROBBERY a lucrative business" screamed the G-P headline over a story describing the robbery – possibly using a gas – of a truck driver and his 11-year old daughter at a rest stop on a German autobahn. Happily – although the driver did lose his wallet and mobile phone – the pair escaped without injury and the cargo was untouched.

"We can offer a safety system with an extremely high customer value for all Volvo trucks" says Lars Göran Ek, manager of the Volvo Anti-theft System project. With one of these installed, we can guarantee that the thieves involved in the German incident would have taken off empty-handed once the siren sounded."

Based on demands from the Dutch insurance industry body, SCM, and its British counterpart, Thatcham, the system took two years to develop.

The driver is free to relax with the Volvo Anti-theft System on board.

The Volvo Anti-theft System project group. From left: Jörgen Lorentzon, Larry Karlsson, P-O Brandt, Bo Olofsson, Hans Emanuel, Lars Göran Ek, Mattias Johansson, Frank Zeljko, Simon Andersson, Christer Nordin, Bengt Ratzmann and Stefan Svensson. Missing: Jan Carlborg, Mark Ball, Bo Franzon, Bodil Lindberg, Björn Henriksson and Lars Brandt.

EU-approved

"In practice, the system is EU-approved following its certification by the British Vehicle Certification Agency (VCA). Excellent teamwork enabled us to meet all of their requirements," remarks Lars Göran.

He adds that Renault already has its own anti-theft system, which, however, is based on a different electronics architecture.

"We expect that the next generation will be common and will include additional functions, such as a gas sensor, as well as a fifth wheel sensor and alarms on compartments with doors to prevent the theft of trailers and loads.

"The current design of the Volvo Anti-theft System provides drivers with excellent protection. It is also interconnected with the engine immobiliser to prevent the theft of the complete rig."

Expert Italians

Lars Göran tells us that the system was developed in collaboration with Delta Elettronica of Italy, which markets the well-known Cobra brand of alarm and safety products.

"Delta has a staff of pleasant and highly expert people," says Lars Göran Ek. "We found out later that we really had chosen the best possible partner. The Volvo project group was also comprised of very progressive people from various departments. Simon Andersson, chief

electrical engineer, and myself both worked full-time, while about ten other members from functions such as Parts, Purchasing, Production, Cabs and Product Design were involved on a part-time basis.

"I would like to congratulate the entire project team which – despite an extremely tight timetable – developed this excellent system to the required standard of quality and within budget. I would also extend sincere thanks to our colleagues, Jan de Korte in the Netherlands and Ray Cattely in Britain, who assisted us with



With its 105 dB, the well-concealed Volvo Anti-theft System siren is an effective deterrent to the would-be thief.

information from their own markets and customers, and also with local certification by the insurance industry bodies in the two countries."

He explains that the complete wiring is housed in a well-pro-



tected location on board and that the siren – which operates at 105 dB(A) for up to five minutes – is built in securely and is equipped with a standby battery. Needless to say, the flashers also operate as part of the alarm system. Operated by the same remote control as the central locking system, the alarm is enabled when the truck is locked and disabled when it is unlocked. The entire system is connected to the on-board J1587 bus and, of course, is also designed for various other add-ons.

Open window no problem

"An LED on the panel indicates when the alarm is switched on – which can also be performed with the window down. Two sensors in the roof respond immediately if an arm is reached

through the open window," explains Lars Göran. "All hatches and doors are also protected by sensors."

The movement sensor can also be disabled temporarily by operating a pushbutton on the panel before setting the alarm. This enables the driver to sleep in the cab or, for example, to leave a dog in it while the alarm system itself remains on.

"The system also incorporates a panic button, which triggers the alarm after two seconds. The truck can be driven with the panic alarm in operation. The alarm is switched off using the same button."

The system is equipped with other sensors, some relatively sophisticated. One is mounted in the front grille, while the electronic control unit is provided with a tilt sensor which detects any attempt to tilt the cab. This sensor incorporates an automatic



An immobiliser is an obvious part of the system.

calibration function to allow the vehicle to be parked on a slope.

During production, the engine control module and the electronic immobiliser are matched with each other, and with other on-board control modules, with the aim of frustrating attempted theft by replacing the ECM.

Lars Göran Ek mentions that the system is available only on new vehicles and not as an accessory. This guarantees the quality and reliability of the system since retrofitting of the alarm would be a major job. The value to the customer is also increased since a factory-fitted alarm may attract a reduced insurance premium or a lower excess than a retrofitted one.

"In future, it is possible that contracts to operate in certain areas will be awarded only to hauliers with anti-theft alarms," believes Lars Göran Ek. ■



Peter Lingman has just received his licentiate for his thesis on retardation control.

Freddy Fuxin is a graduate of Luleå University of Technology. He became a licentiate in 2001 and hopes to receive his doctorate in 2003. His colleague, Peter Lingman from Chalmers University of Technology, Gothenburg (CTH), has just received his licentiate. Both are deeply involved in research and are vital members of Volvo 3P's PhD programme.

SINCE EFFECTIVE cooperation with universities and research institutes is vital to a technology intensive company like Volvo, several of the Volvo companies

operate PhD programmes. This applies to Volvo 3P, where Stefan Edlund, manager of Vehicle Simulations & Technical Systems, has been working to establish a long-term programme of research in the product development area.

"Unlike many other programmes of this type, our aim is to build up successively to a level at which we can continue to provide areas of strategic importance to the company with one to two doctoral candidates per year," he explains.

Freddy Fuxin and Peter Lingman are two of the six prospective PhDs currently involved in the programme.

Geometry the keyword

"Geometry is the keyword of my

research," begins Freddy, showing us his licentiate thesis with the title of *Evolution and communication of geometry based product information within an extended enterprise*.

"The purpose of the project is to eliminate rework. Modern design is based on 3D geometry and many organisational functions 'downstream' of the design function can benefit from access to a variety of such information. Two-dimensional CAD is no longer good enough."

Many users

"The concept of an extended enterprise embraces the geometry users," says Freddy. "These are to be found both within the various units – in areas such as industrial design, chassis, cab, power train and electrical systems design, parts and service, planning, and so on – and outside the company in the form of partners and suppliers."

"Digital mock-ups are used as an integral part of this comprehensive process. One result of the increased use of geometry is that the number of physical mock-ups can be reduced in early stages. The reduction also implies that increased number of personnel must be able to work with geometrical applications in their respective areas of responsibility. In my thesis, theoretical findings and practical experience will be interwoven to develop a geometry management process. If a research project is to achieve ►

"Two-dimensional CAD is no longer good enough"

- scientific relevance, it must be related to and challenge existing scientific literature in the field.”

Full braking control

We meet Peter Lingman at CTH, where he is in the final stages of writing his licentiate-ship thesis.

“Although I did most of the work out at Volvo, it’s important to me to have a desk here at CTH. This is a great help to me in my research and is also advantageous to the collaboration between the two,” comments Peter, adding that the title of his thesis is *Integrated retardation control*.

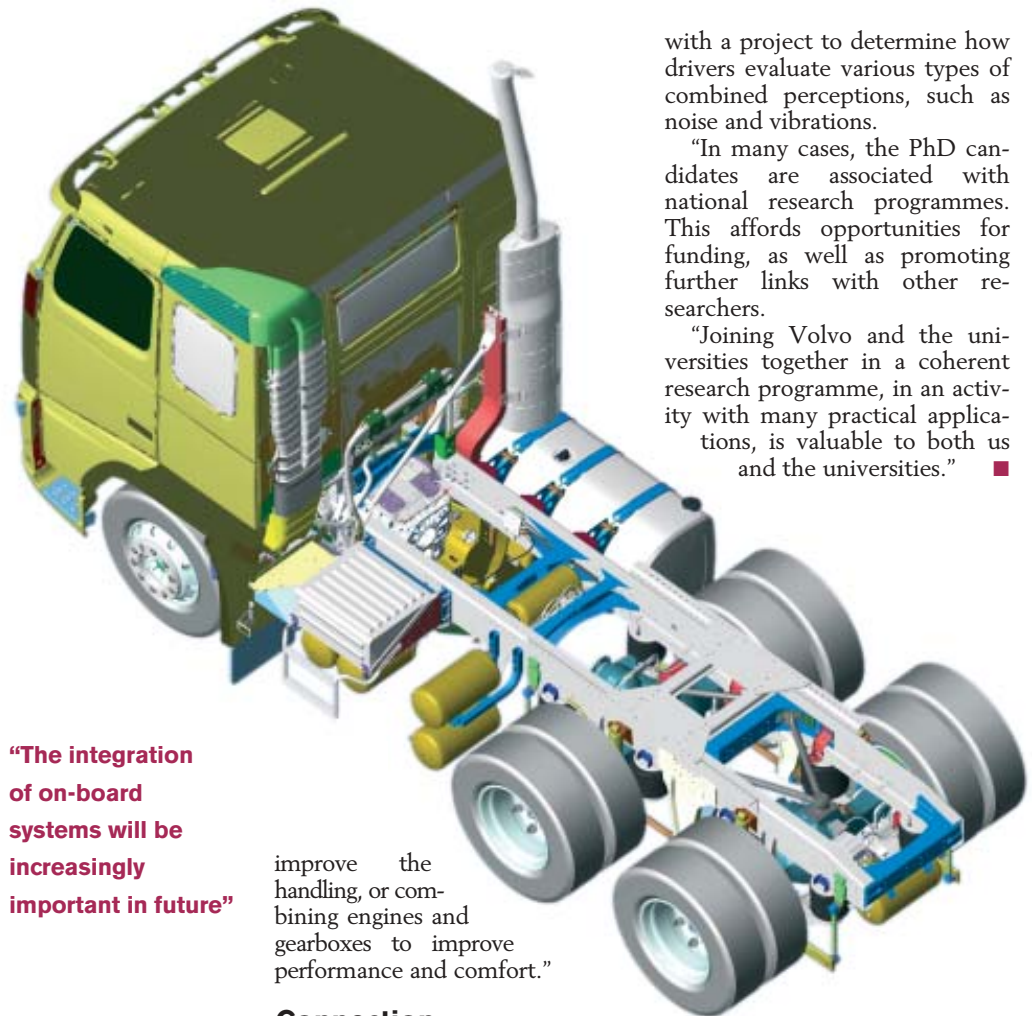
He mentions that he is the first PhD candidate to work at Chassis, where he is involved in control technology and modelling in relation to the design of the basic braking system in a truck. In addition to the ordinary service brakes, this includes the Volvo engine brake (VEB) – the best on the market – and the option of a compact retarder (after the gearbox).

Performance, safety and cost

“The problem,” explains Peter, “is that these different elements need to be married together in an intelligent manner – in other words, a retardation strategy is needed. The greater the number of systems involved, the more intelligent the control system must be – all with the aim of assisting the driver in an increasingly complex situation.

“I am presently working to identify an optimum mode of interaction between the different braking elements in terms of maximum safety, while contributing to the highest possible average speed and efficiency, for example by minimising the cost of brake and tyre wear,” adds Peter Lingman.

“The integration of on-board systems will be increasingly important in future and the potential for improving vehicle characteristics is very considerable. This may be a matter of combining braking and steering systems to



“The integration of on-board systems will be increasingly important in future”

improve the handling, or combining engines and gearboxes to improve performance and comfort.”

Connection between projects

“It is also important that the individual research projects should combine to form a whole in order to utilise synergies and promote cross-functional work,” says Stefan Edlund.

“In this context, Freddy’s work also provides the basis for further advanced research to develop the optimum design process for cast components. Peter’s project relates to research aimed at identifying environmental requirements for our vehicles by means of advanced analysis of the signals in the on-board data buses. It also coupled

with a project to determine how drivers evaluate various types of combined perceptions, such as noise and vibrations.

“In many cases, the PhD candidates are associated with national research programmes. This affords opportunities for funding, as well as promoting further links with other researchers.

“Joining Volvo and the universities together in a coherent research programme, in an activity with many practical applications, is valuable to both us and the universities.” ■

An almost complete digital mock-up (DMU).



Freddy Fuxin is researching methods of linking all users of 3D geometry in the development process.

Technology magazine

Technology magazine – a news magazine for engineers in the Volvo Group throughout the world – is published by Group Issue Board – Technology (GIB-T)

Proprietor, GIB-T: Lars-Göran Rosengren, tel. +46 31 66 65 67, e-mail: lars-goran.rosengren@volvo.com

Adm. Coordinator, GIB-T: Carita Vikstedt, tel +46 31 66 65 61, e-mail: carita.vikstedt@volvo.com

Editor-in-chief and Publisher: Henrik Moberger, Tärnan Reportage AB, Göteborg, tel. +46 31 778 05 55, e-mail: henrik@tarnanrep.se

Translation and language editing: Tom Byrne, Techtrans Ireland, Cork, e-mail: techirl@iol.ie Photography (in this issue): Roger Lundsten, Göte Eriksson, Henrik Moberger

Graphic design: Anders Bodebeck, Göteborg, e-mail: anders@bodebeck.se Repro and printing: Typoprint AB, Göteborg

Reprints: Articles (including extracts and illustrations) published in Technology magazine may be reproduced only by permission of the editor-in-chief